2 of 3 #6

Please type a plus sign (+) inside this box ➞ [+]

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application	09/703,502
Filing Date	October 31, 2000
First Named	**Majid Anwar**
Group Art Unit	2673
Examiner Name	**Not Assigned**

Total Number of Pages in This Submission	1	**Attorney Docket Number** **PGLD-P01-001**

ENCLOSURES   *(check all that apply)*

- [ ] Fee Transmittal Form
  - [ ] Fee Attached
- [ ] Amendment / Response
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [X] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
  - [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53

- [ ] Assignment Papers *(for an Application)*
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____

- [ ] After Allowance Communication to Group
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to Group *(Appeal Notice, Brief, Reply Brief)*
- [ ] Proprietary Information
- [ ] Status Letter
- [X] Other Enclosure(s) *(please identify below)*:

Return Postcard

Remarks

Commissioner if hereby authorized to charge any fees due or any credits due to Deposit Account 18-1945 referencing the attorney docket number above.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	Edward J. Kelly Customer Number 28120 Ropes & Gray One International Place, Boston, MA 02110
Signature	*[signature]*
Date	August 10, 2001

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231 on this date: **August 10, 2001**

Typed or printed name	Maureen Prestia		
Signature	*Maureen Prestia*	Date	August 10, 2001

age Blank (uspto)

RECEIVED

AUG 2 2 2001

Technology Center 2600

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.
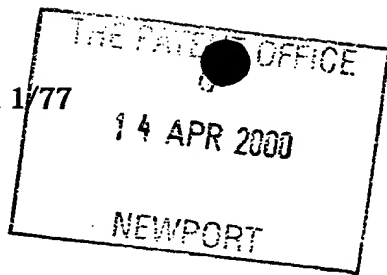
Signed   *[signature]*

Dated   5 June 2001

THE PATENT OFFICE
14 APR 2000
NEWPORT

The Patent Office

17APR00 E529475-6 D02884
P01/7700 0.00-0009129.8

1/77

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

1.	Your reference	P24534/TCO/JCO

2.	Patent application number *(The Patent Office will fill in this part)*	**0009129.8**	**14 APR 2000**

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Picsel Technologies Limited
Shaftesbury House
5 Waterloo Street
GLASGOW
G2 6AY

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation

United Kingdom

787822 6 001

4. Title of the invention

"Digital Document Processing"

5. Name of your agent *(if you have one)*

Murgitroyd & Company

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

373 Scotland Street
GLASGOW
G5 8QA

Patents ADP number *(if you know it)*

1198013

6.	If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number	Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7.	If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application	Number of earlier application · Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*
a) *any applicant named in part 3 is not an inventor, or*
b) *there is an inventor who is not named as an applicant, or*
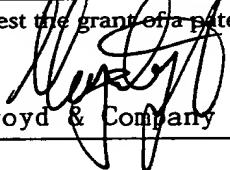c) *any named applicant is a corporate body.*
See note (d))

Yes

9. Enter the number of sheets for any of the
   following items you are filing with this form.
   Do not count copies of the same document

Continuation sheets of this form	—
Description	20
Claim *(s)*	7
Abstract	—
Drawing *(s)*	1

10. If you are also filing any of the following,
    state how many against each item.

Priority documents	—
Translations of priority documents	—
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	—
Request for preliminary examination and search *(Patents Form 9/77)*	—
Request for substantive examination *(Patents Form 10/77)*	—
Any other documents *(please specify)*	—

11.	I/We request the grant of a patent on the basis of this application.	
	Signature Murgitroyd & Company	Date 13 April 2000
12. Name and daytime telephone number of person to contact in the United Kingdom	John Cooper	0141 307 8400

Warning
After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes
a) *If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505.*

b) *Write your answers in capital letters using black ink or you may type them.*

c) *If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.*

d) *If you have answered 'Yes' Patents Form 7/77 will need to be filed.*

e) *Once you have filled in the form you must remember to sign and date it.*

f) *For details of the fee and ways to pay please contact the Patent Office.*

1   **"Digital Document Processing"**

2

3   **Field of the Invention**

4

5   The invention relates to data processing systems. More

6   particularly, the invention relates to methods and

7   systems for processing "digital documents" (as defined

8   herein) and to devices incorporating such methods and

9   systems. In general terms, the invention is concerned

10   with generating an output representation of a source

11   document; e.g. as a visual display or as hardcopy.

12

13   **Background to the Invention**

14

15   As used herein, the term "digital document" is used to

16   describe a digital representation of any type of data

17   processed by a data processing system which is

18   intended, ultimately, to be output in some form, in

19   whole or in part, to a human user, typically by being

20   displayed or reproduced visually (e.g. by means of a

21   visual display unit or printer), or by text-to-speech

22   conversion, etc. A digital document may include any

1 features capable of representation, including but not
2 limited to the following: text; graphical images;
3 animated graphical images; full motion video images;
4 interactive icons, buttons, menus or hyperlinks. A
5 digital document may also include non-visual elements
6 such as audio (sound) elements.
7
8 Data processing systems, such as personal computer
9 systems, are typically required to process "digital
10 documents", which may originate from any one of a
11 number of local or remote sources and which may exist
12 in any one of a wide variety of data formats ("file
13 formats"). In order to generate an output version of
14 the document, whether as a visual display or printed
15 copy, for example, it is necessary for the computer
16 system to interpret the original data file and to
17 generate an output compatible with the relevant output
18 device (e.g. monitor, or other visual display device,
19 or printer). In general, this process will involve an
20 application program adapted to interpret the data file,
21 the operating system of the computer, a software
22 "driver" specific to the desired output device and, in
23 some cases (particularly for monitors or other visual
24 display units), additional hardware in the form of an
25 expansion card.
26
27 This conventional approach to the processing of digital
28 documents in order to generate an output is inefficient
29 in terms of hardware resources, software overheads and
30 processing time, and is completely unsuitable for low
31 power, portable data processing systems, including
32 wireless telecommunication systems, or for low cost

1   data processing systems such as network terminals, etc.
2   Other problems are encountered in conventional digital
3   document processing systems, including the need to
4   configure multiple system components (including both
5   hardware and software components) to interact in the
6   desired manner, and inconsistencies in the processing
7   of identical source material by different systems (e.g.
8   differences in formatting, colour reproduction, etc).
9   In addition, the conventional approach to digital
10 document processing is unable to exploit the
11 commonality and/or re-usability of file format
12 components.
13
14 **Summary of the Invention**
15
16 It is an object of the present invention to provide
17 digital document processing methods and systems, and
18 devices incorporating such methods and systems, which
19 obviate or mitigate the aforesaid disadvantages of
20 conventional methods and systems.
21
22 The invention, in its various aspects, is defined in
23 the Claims appended hereto. Further aspects and
24 features of the invention will be apparaent from the
25 following description.
26
27 In a first aspect, the invention relates to a digital
28 document processing system comprising:
29   means for receiving an input bytestream
30 representing source data in one of a plurality of
31 predetermined data formats;

1   interpreting means for interpreting said

2   bytestream;

3   converting means for converting interpreted

4   content from said bytestream into an internal

5   representation data format;

6   means for processing said internal representation

7   data so as to generate output representation data

8   adapted to drive an output device.

9

10   In a second aspect, the invention relates to a

11   graphical user interface for a data processing system

12   in which interactive visual displays employed by the

13   user interface are generated by means of a digital

14   document processing system in accordance with the first

15   aspect of the invention and to data processing systems

16   incorporating such a graphical user interface.

17

18   In further aspects, the invention relates to various

19   types of device incorporating a digital document

20   processing system in accordance with the first aspect

21   of the invention, including hardware devices, data

22   processing systems and peripheral devices.

23

24   In still another aspect, the invention relates to a

25   graphical user interface for a data processing system,

26   having one or more of a number of novel and/or enhanced

27   features, and to data processing systems incorporating

28   such a graphical user interface.

29

30   Embodiments of the invention will now be described, by

31   way of example only, with reference to the accompanying

32   drawing.

1

2

3 **Brief Description of the Drawing**

4

5 Fig. 1 is a block diagram illustrating an embodiment of

6 a digital document processing system in accordance with

7 the present invention.

8

9 **Detailed Description of the Preferred Embodiments**

10

11 Referring now to the drawings, a digital document

12 processing system 8 embodying the invention is

13 illustrated in Fig. 1.

14

15 In general terms, the system 8 will process a source

16 document 10 comprising a data file in a known format.

17 The input to the system 8 is a bytestream comprising

18 the content of the source document. An input module 11

19 identifies the file format of the source document on

20 the basis of any one of a variety of criteria, such as

21 an explicit file-type identification within the

22 document, from the file name (particularly the file

23 name extension), or from known characteristics of the

24 content of particular file types. The bytestream is

25 input to a "document agent" 12, specific to the file

26 format of the source document. The document agent 12 is

27 adapted to interpret the incoming bytestream and to

28 convert it into a standard format employed by the

29 system 8, resulting in an internal representation 14 of

30 the source data in a "native" format suitable for

31 processing by the system 8. The system 8 will

32 generally include a plurality of different document

1 agents 12, each adapted to process one of a

2 corresponding plurality of predetermined file formats.

3

4 The system 8 may also be applied to input received from

5 an input device such as a digital camera or scanner.

6 In this case the input bytestream may originate

7 directly from the input device, rather from a "source

8 document" as such. However, the input bytestream will

9 still be in a predictable data format suitable for

10 processing by the system and, for the purposes of the

11 invention, input received from such an input device may

12 be regarded as a "source document".

13

14 The document agent 12 employs a library 16 of standard

15 objects to generate the internal representation 14,

16 which describes the content of the source document in

17 terms of a collection of generic objects as defined in

18 the library 16, together with parameters defining the

19 properties of specific instances of the various generic

20 objects within the document. It will be understood

21 that the internal representation may be saved/stored in

22 a file format native to the system and that the range

23 of possible source documents 10 input to the system 8

24 may include documents in the system's native file

25 format. It is also possible for the internal

26 representation 14 to be converted into any of a range

27 of other file formats if required, using suitable

28 conversion agents (not shown).

29

30 The generic objects employed in the internal

31 representation 14 will typically include: text, bitmap

32 graphics and vector graphics (which may or may not be

1 animated and which may be two- or three-dimensional),
2 video, audio, and a variety of types of interactive
3 object such as buttons and icons. The parameters
4 defining specific instances of generic objects will
5 generally include dimensional co-ordinates defining the
6 physical shape, size and location of the object and any
7 relevant temporal data for defining objects whose
8 properties vary with time (allowing the system to deal
9 with dynamic document structures and/or display
10 functions). For text objects, the parameters will
11 normally also include a font and size to be applied to
12 a character string. Object parameters may also define
13 other properties, such as transparency.
14
15 The format of the internal representation 14 separates
16 the "structure" (or "layout") of the documents, as
17 described by the object types and their parameters,
18 from the "content" of the various objects; e.g. the
19 character string (content) of a text object is
20 separated from the font, character size and dimensional
21 parameters of the object; the image data (content) of a
22 graphic object is separated from its dimensional
23 parameters. This allows document structures to be
24 defined in a very compact manner and provides the
25 option for content data to be stored remotely and to be
26 fetched by the system only when needed.
27
28 The internal representation 14 describes the document
29 and its constituent objects in terms of "high-level"
30 descriptions.
31

1 The internal representation data 14 is input to a

2 parsing and rendering module 18 which generates a

3 context-specific representation 20 or "view" of the

4 document represented by the internal representation 14.

5 The required view may be of the whole document or of

6 part(s) (subset(s)) thereof. The parser/renderer 18

7 receives view control inputs 40 which define the

8 viewing context and any related temporal parameters of

9 the specific document view which is to be generated.

10 For example, the system may be required to generate a

11 zoomed view of part of a document, and then to pan or

12 scroll the zoomed view to display adjacent portions of

13 the document. The view control inputs 40 are

14 interpreted by the parser/renderer 18 in order to

15 determine which parts of the internal representation

16 are required for a particular view and how, when and

17 for how long the view is to be displayed.

18

19 The context-specific representation/view 20 is again

20 expressed in terms of object types and parameters,

21 using the library 16.

22

23 The parser/renderer 18 may also perform additional pre-

24 processing functions on the relevant parts of the

25 internal representation 14 when generating the required

26 view 20 of the source document 10. The view

27 representation 20 is input to a shape processor module

28 22 for final processing to generate a final output 24,

29 in a format suitable for driving an output device 26

30 (or multiple output devices), such as a display device

31 or printer.

32

1   The pre-processing functions of the parser/renderer 18
2   may include colour correction, resolution
3   adjustment/enhancement and anti-aliasing. Resolution
4   enhancement may comprise scaling functions which
5   preserve the legibility of the content of objects when
6   displayed or reproduced by the target output device.
7   Resolution adjustment may be context-sensitive; e.g.
8   the display resolution of particular objects may be
9   reduced while the displayed document view is being
10   panned or scrolled and increased when the document view
11   is static.

12

13   There may be a feedback path 42 between the
14   renderer/parser 18 and the internal representation 14;
15   e.g. for the purpose of triggering an update of the
16   content of the internal representation 14, such as in
17   the case where the document 10 represented by the
18   internal representation comprises a multi-frame
19   animation.

20

21   The output representation 20 from the parser/renderer
22   18 expresses the document in terms of "primitive"
23   objects. For each document object, the representation
24   20 preferably defines the object at least in terms of a
25   physical, rectangular boundary box, the actual shape of
26   the object bounded by the boundary box, the data
27   content of the object, and its transparency.

28

29   The shape processor 22 interprets the representation 20
30   and converts it into an output frame format 24
31   appropriate to the target output device 26; e.g. a dot-
32   map for a printer, vector instruction set for a

1   plotter, or bitmap for a display device. An output

2   control input 44 to the shape processor 22 defines the

3   necessary parameters for the shape processor 22 to

4   generate output 24 suitable for a particular output

5   device 26.

6

7   The shape processor 22 preferably processes the objects

8   defined by the view representation 20 in terms of

9   "shape" (i.e. the outline shape of the object), "fill"

10 (the data content of the object) and "alpha" (the

11 transparency of the object), performs scaling and

12 clipping appropriate to the required view and output

13 device, and expresses the object in terms appropriate

14 to the output device (typically in terms of pixels by

15 scan conversion or the like, for most types of display

16 device or printer).

17

18 The shape processor 22 preferably includes an edge

19 buffer which defines the shape of an object in terms of

20 scan-converted pixels, and preferably applies anti-

21 aliasing to the outline shape. Anti-aliasing is

22 preferably performed in a manner determined by the

23 characteristics of the output device 26 (i.e. on the

24 basis of the control input 44), by applying a grey-

25 scale ramp across the object boundary. This approach

26 enables memory efficient shape-clipping and shape-

27 intersection processes.

28

29 A look-up table may be employed to define multiple tone

30 response curves, allowing non-linear rendering control

31 (gamma correction).

32

1   The individual objects processed by the shape processor

2   22 are combined in the composite output frame 24. The

3   quality of the final output can also be controlled by

4   the user via the output control input 44.

5

6   The shape processor 22 has a multi-stage pipeline

7   architecture which lends itself to parallel processing

8   of multiple objects, or of multiple documents, or of

9   multiple subsets of one or more document, by using

10   multiple instances of the shape processor pipeline.

11   The pipeline architecture is also easily modified to

12   include additional processing functions (e.g. filter

13   functions) if required. Outputs from multiple shape

14   processors 22 may generate multiple output frames 24 or

15   may be combined in a single output frame 24.

16

17   The system architecture is modular in nature. This

18   enables, for example, further document agents to be

19   added as and when required, to deal with additional

20   source file formats. The modular architecture also

21   allows individual modules such as the library 16,

22   parser/renderer 18 or shape processor 22 to be modified

23   or upgraded without requiring changes to other modules.

24

25   The system architecture as a whole also lends itself to

26   parallelism in whole or in part for simultaneous

27   processing of multiple input documents 10a, 10b etc. or

28   subsets of documents, in one or more file formats, via

29   one or more document agents 12, 12a. The integrated,

30   modular nature of the system allows multiple instances

31   of system modules to be spawned within a data

32   processing system or device as and when required,

1   limited only by available processing and memory

2   resources.

3

4   The potential for flexible parallelism provided by the

5   system as a whole and the shape processor 22 in

6   particular allows the display path for a given device

7   to be optimised for available bandwidth and memory.

8   Display updates and animations may be improved, being

9   quicker and requiring less memory. The

10   object/parameter document model employed is

11   deterministic and consistent. The system is fully

12   scalable and allows multiple instances of the system

13   across multiple CPUs.

14

15   The parser/renderer 18 and shape processor 22 interact

16   dynamically in response to view control inputs 40, in a

17   manner which optimises the use of available memory and

18   bandwidth. This applies particularly to re-draw

19   functions when driving a visual display, e.g. when the

20   display is being scrolled or panned by a user.

21

22   Firstly, the system preferably implements a scalable

23   deferred re-draw model, such that the display

24   resolution of a document view, or of one or more

25   objects within a view, varies dynamically according to

26   the manner in which the display is to be modified. As

27   previously mentioned, this might typically involve an

28   object being displayed at reduced resolution whilst

29   being moved on-screen and being displayed at full

30   resolution when at rest. The system may employ

31   multiple levels of display quality for this purpose.

32   Typically, this will involve pre-built, low resolution

1   bitmap representations of document objects and/or
2   dynamically built and scaled bitmaps, with or without
3   interpolation.   This approach provides a highly
4   responsive display which makes best use of available
5   memory/bandwidth.
6
7   The interaction of the renderer/parser 18 and shape
8   processor 22 preferably also involves dividing the page
9   to be viewed into zones.   Each zone has associated with
10 it a list of all objects contained within or
11 overlapping that zone.   Re-draws can then be processed
12 on the basis of the zones, so that the system need only
13 process objects associated with the relevant zones
14 affected by the re-draw.   This approach facilitates
15 parallel processing and improves efficiency and reduces
16 redundancy.   The use of zones also facilitates the use
17 of the system to generate different outputs for
18 different display devices (e.g. for generating a
19 composite/mosaic output for display by an array of
20 separate display screens).
21
22 The ability to process transparent objects is a
23 significant feature of the system.   However, this
24 necessitates the use of off-screen buffering in the
25 shape processor 22 in order to assemble a final output
26 frame.   Typically, an off-screen buffer will cover an
27 area larger than the immediate display area, allowing a
28 limited degree of panning/scrolling within the buffer
29 area, but the entire buffer has to be re-centred and
30 re-built when the required display moves outwith these
31 limits.   Preferably, the system improves the efficiency
32 of such buffering processes by defining the buffer

1   content as an array of tiles, indexed in an ordered

2   list. When the required display view moves outwith the

3   buffer area, it is then only necessary to discard those

4   tiles which are no longer required, build new tiles to

5   cover the new area of the display and update the tile

6   list. This is faster and more efficient than

7   conventional buffering processes and facilitates the

8   use of multiple buffering and off-screen caching. It

9   also facilitates interruptable re-draw functions (e.g.

10 so that a current re-draw may be interrupted and a new

11 re-draw initiated in response to user input).

12

13 The zoning and tiling schemes described above are

14 independent in principle but may be combined

15 advantageously; i.e. zones may correlate with one or

16 more tiles. Again this facilitates parallelism and

17 optimises use of system resources.

18

19 The system preferably employs a device-independent

20 colour model, suitably a luminance/chrominance model

21 such as the CIE L*a*b* 1976 model. This reduces

22 redundancy in graphic objects, improves data

23 compressibility and improves consistency of colour

24 output between different output devices. Device-

25 dependent colour correction can be applied on the basis

26 of the device-dependent control input 44 to the shape

27 processor 22.

28

29 Fig. 1 shows the system having an input end at which

30 the source bytestream is received and an output end

31 where the final output frame 24 is output from the

32 system. However, it will be understood that the system

1   may include intermediate inputs and outputs at other

2   intermediate stages, such as for fetching data content

3   or for saving/converting data generated in the course

4   of the process.

5

6   The system 8 may be incorporated into a variety of

7   types of data processing systems and devices, and into

8   peripheral devices, in a number of different ways.

9   In a general purpose data processing system (the "host

10   system"), the system of the present invention may be

11   incorporated alongside the operating system and

12   applications of the host system or may be incorporated

13   fully or partially into the host operating system.

14

15   For example, the system of the present invention

16   enables rapid display of a variety of types of data

17   files on portable data processing devices with LCD

18   displays without requiring the use of browsers or

19   application programs. This class of data processing

20   devices requires small size, low power processors for

21   portability. Typically, this requires the use of

22   advanced RISC-type core processors designed into ASICs

23   (application specific integrated circuits), in order

24   that the electronics package is as small and highly

25   integrated as possible. This type of device also has

26   limited random access memory and typically has no non-

27   volatile data store (e.g. hard disk). Conventional

28   operating system models, such as are employed in

29   standard desktop computing systems (PCs), require high

30   powered central processors and large amounts of memory

31   in order to process digital documents and generate

32   useful output, and are entirely unsuited for this type

1   of data processing device. In particular, conventional

2   systems do not provide for the processing of multiple

3   file formats in an integrated manner. By contrast, the

4   present invention utilises common processes and

5   pipelines for all file formats, thereby providing a

6   highly integrated document processing system which is

7   extremely efficient in terms of power consumption and

8   usage of system resources.

9

10 The system of the present invention may be integrated

11 at the BIOS level of portable data processing devices

12 to enable document processing and output with much

13 lower overheads than conventional system models.

14 Alternatively, the invention may be implemented at the

15 lowest system level just above the transport protocol

16 stack. For example, the system may be incorporated

17 into a network device (card) or system, to provide in-

18 line processing of network traffic (e.g. working at the

19 packet level in a TCP/IP system).

20

21 In a particular device, the system of the invention is

22 configured to operate with a predetermined set of data

23 file formats and particular output devices; e.g. the

24 visual display unit of the device and/or at least one

25 type of printer.

26

27 Examples of portable data processing devices which may

28 employ the present system include "palmtop" computers,

29 portable digital assistants (PDAs, including tablet-

30 type PDAs in which the primary user interface comprises

31 a graphical display with which the user interacts

32 directly by means of a stylus device), internet-enabled

1 mobile telephones and other communications devices,

2 etc.

3

4 The system may also be incorporated into low cost data

5 processing terminals such as enhanced telephones and

6 "thin" network client terminals (e.g. network terminals

7 with limited local processing and storage resources),

8 and "set-top boxes" for use in interactive/internet-

9 enabled cable TV systems.

10

11 When integrated with the operating system of a data

12 processing system, the system of the present invention

13 may also form the basis of a novel graphical user

14 interface (GUI) for the operating system (OS).

15 Documents processed and displayed by the system may

16 include interactive features such as menus, buttons,

17 icons etc. which provide the user interface to the

18 underlying functions of the operating system. By

19 extension, a complete OS/GUI may be expressed,

20 processed and displayed in terms of system "documents".

21 The OS/GUI could comprise a single document with

22 multiple "chapters".

23

24 The system enables and/or facilitates a variety of

25 novel and/or enhanced GUI features, including, but not

26 limited to, the following:

27

28 -   The use of thumbnail images of documents for

29 navigation purposes and for recording user activities

30 (history); e.g. when browsing network content.

1   -   Document interaction functions and gesture-based

2   commands using pointing devices and/or touch-screen

3   technology; e.g.:

4   allowing document interaction by means of gestures

5   analogous to actions used with physical documents

6   or books, such as dragging a pointer across a page

7   in order to turn the page ("page-flipping"),

8   dragging a pointer to curl back the corner of a

9   page to view underlying parts of succeeding pages

10   ("page curl");

11   allowing tool selection by dragging tools from

12   toolbars and de-selection by dragging tools to

13   predetermined parts of the display;

14   symbolic cursor movements to indicate particular

15   OS commands, such as "tick", "cross-out" and

16   "circle" movements for "OK", ·delete" and

17   "select"; editing commands based on conventional

18   "proof-readers" notation;

19   -   Re-formatting document views by rotation or

20   switching between landscape and portrait formats;

21   -   Utilities and tools such as:

22   a floating virtual "magnifying glass" which

23   magnifies the underlying document area, in which

24   the magnified view is based on the internal

25   representation 14 of the source document rather

26   than on a bitmap representation of the document

27   and which may modify document parameters such as

28   background and/or foreground colours;

29   a floating virtual, translucent keyboard for text

30   input using a pointing device/touch screen;

1   a floating, virtual, translucent ruler which is
2   re-scalable using any of a variety of user-
3   selectable units.
4 -   Alternative menu or "tabbed page" drag out/pull
5 down functions.
6 -   Simulation of physical inertia/momentum applied to
7 page scrolling/panning functions (e.g. when a zoomed
8 display of a page is dragged to scroll the display and
9 released, the moving display decelerates gradually
10 after release).
11
12 GUI features of this type provide new or enhanced
13 functionality and/or improve the subjective quality of
14 the user interface.
15
16 The system of the present invention may also be
17 incorporated into peripheral devices such as hardcopy
18 devices (printers and plotters), display devices (such
19 as digital projectors), networking devices, input
20 devices (cameras, scanners etc.) and also multi-
21 function peripherals (MFPs).
22
23 When incorporated into a printer, the system enables
24 the printer to receive raw data files from the host
25 data processing system and to reproduce the content of
26 the original data file correctly, without the need for
27 particular applications or drivers provided by the host
28 system. This avoids the need to configure a computer
29 system to drive a particular type of printer. The
30 present system directly generates a dot-mapped image of
31 the source document suitable for output by the printer
32 (this is true whether the system is incorporated into

1 the printer itself or into the host system). Similar

2 considerations apply to other hardcopy devices such as

3 plotters.

4

5 When incorporated into a display device, such as a

6 projector, the system again enables the device to

7 display the content of the original data file correctly

8 without the use of applications or drivers on the host

9 system, and without the need for specific configuration

10 of the host system and/or display device. Peripheral

11 devices of these types, when equipped with the present

12 system, may receive and output data files from any

13 source, via any type of data communications network.

14

15 From the foregoing, it will be understood that the

16 system of the present invention may be "hard-wired;

17 e.g. implemented in ROM and/or integrated into ASICs or

18 other single-chip systems, or may be implemented as

19 firmware (programmable ROM such as flashable ePROM), or

20 as software, being stored locally or remotely and being

21 fetched and executed as required by a particular

22 device.

23

24 Improvements and modifications may be incorporated

25 without departing from the scope of the present

26 invention.

27

Claims

1.   A digital document processing system comprising:
      means for receiving an input bytestream
representing source data in one of a plurality of
predetermined data formats;
      interpreting means for interpreting said
bytestream;
      converting means for converting interpreted
content from said bytestream into an internal
representation data format;
      means for processing said internal representation
data so as to generate output representation data
adapted to drive an output device.

2.   A system as claimed in Claim 1, wherein said
source data defines the content and structure of a
digital document, and wherein said internal
representation data describes said structure in terms
of generic objects defining a plurality of data types
and parameters defining properties of specific
instances of generic objects, separately from said
content.

3.   A system as claimed in Claim 2, further including
a library of generic objects, said internal
representation data being based on the content of said
library.

4.   A system as claimed in Claim 2 or Claim 3,
including a parsing and rendering module adapted to
generate an object and parameter based representation

1   of a specific view of at least part of said internal

2   representation data, on the basis of a first control

3   input to said parsing and rendering module.

4

5   5.   A system as defined in Claim 4, further including

6   a shape processing module adapted to receive said

7   object and parameter based representation of said

8   specific view from said parsing and rendering module

9   and to convert said object and parameter based

10   representation into an output data format suitable for

11   driving a particular output device.

12

13   6.   A system as claimed in Claim 5, wherein said shape

14   processing module processes said objects on the basis

15   of a boundary box defining the boundary of an object, a

16   shape defining the actual shape of the object bounded

17   by the boundary box, the data content of the object and

18   the transparency of the object.

19

20   7.   A system as claimed in Claim 6, wherein said shape

21   processor is adapted to apply grey-scale anti-aliasing

22   to the edges of said objects.

23

24   8.   A system as claimed in Claim 5, Claim 6 or Claim

25   7, wherein said shape processing module has a pipeline

26   architecture.

27

28   9.   A system as claimed in any one of Claims 5 to 8,

29   wherein said shape processor employs at least one off-

30   screen display buffer to generate said output data and

31   wherein said at least one off-screen display buffer is

32   defined by an indexed array of tiles.

1   10. A system as defined in Claim 9, wherein updating
2   of the content of said at least one off-screen display
3   buffer is performed by removing selected tiles from
4   said array, adding new tiles to said array, and up-
5   dating the indexing of said tiles.
6
7   11. A system as claimed in any one of Claims 5 to 10,
8   wherein said parsing and rendering module is adapted to
9   define at least part of said internal representation
10 data it terms of a plurality of zones, each zone having
11 an associated list of objects contained within and
12 overlapping said zone, and said shape processor is
13 adapted to process said object and parameter based
14 representation on the basis of said zones and
15 associated lists.
16
17 12. A system as claimed in any one of Claims 5 to 11,
18 wherein the quality of a display view represented by
19 said output data may be varied dependent on said first
20 control input.
21
22 13. A system as claimed in Claim 12, wherein the
23 quality of said display view may be varied in multiple
24 steps.
25
26 14. A system as claimed in any one of Claims 2 to 13,
27 wherein said object parameters include dimensional,
28 physical and temporal parameters.
29
30 15. A system as claimed in any preceding Claim,
31 wherein the system employs a chrominance/luminance-
32 based colour model to describe colour data.

16.   A system as claimed in any preceding Claim,
wherein the system is adapted for multiple parallel
implementation in whole or in part for processing one
or more sets of source data from one or more data
sources and for generating one or more sets of output
representation data.

17.   A graphical user interface for a data processing
system in which interactive visual displays employed by
the user interface are generated by means of a digital
document processing system as claimed in any one of
Claims 1 to 16.

18.   A data processing device incorporating a graphical
user interface as claimed in Claim 17.

19.   A hardware device for data processing and/or
storage encoding a digital document processing system
as claimed in any one of Claims 1 to 16.

20.   A hardware device as claimed in Claim 19, further
including a core processor system.

21.   A hardware device as claimed in Claim 20, wherein
said core processor is a RISC processor.

22.   A data processing system including a digital
document processing system as claimed in any one of
Claims 1 to 16.

1   23.   A data processing system as claimed in Claim 22,
2   wherein said data processing system comprises a
3   portable data processing device.
4

5   24.   A data processing system as claimed in Claim 23,
6   wherein said portable data processing device comprises
7   a wireless telecommunications device.
8

9   25.   A data processing system as claimed in Claim 22,
10   wherein said data processing system comprises a network
11   user-terminal.
12

13   26.   A peripheral device for use with a data processing
14   system, including a digital document processing system
15   as claimed in any one of Claims 1 to 16.
16

17   27.   A peripheral device as claimed in Claim 26,
18   wherein said peripheral device is a visual display
19   device.
20

21   28.   A peripheral device as claimed in Claim 26,
22   wherein said peripheral device is a hardcopy output
23   device.
24

25   29.   A peripheral device as claimed in Claim 26,
26   wherein said peripheral device is an input device.
27

28   30.   A peripheral device as claimed in Claim 26,
29   wherein said peripheral device is a network device.
30

1   31.   A peripheral device as claimed in Claim 26,
2   wherein said peripheral device is a multi-function
3   peripheral device.
4
5   32.   A graphical user interface for a data processing
6   system, including at least one of the following
7   features:
8   -   the use of thumbnail images of documents for
9   navigation purposes and for recording user activities;
10   -   document interaction functions and gesture-based
11   commands using pointing devices and/or touch-screen
12   technology, including document interaction by means of
13   gestures analogous to actions used with physical
14   documents or books;
15   -   tool selection by dragging tools from toolbars and
16   de-selection by dragging tools to predetermined parts
17   of the display;
18   -   symbolic cursor movements to indicate commands;
19   -   re-formatting document views by rotation or
20   switching between landscape and portrait formats;
21   -   alternative menu or "tabbed page" drag out/pull
22   down functions.
23   -   simulated physical inertia/momentum applied to
24   page scrolling/panning functions.
25
26   33.   A graphical user interface for a data processing
27   system, including at least one of the following
28   utilities/tools:
29   - a floating virtual magnifying glass adapted to
30   magnify an underlying document area, in which the
31   magnified view is based on source document data;

1   - a floating virtual, translucent keyboard for

2   text input using a pointing device/touch screen;

3   - a floating, virtual, translucent ruler which is

4   re-scalable using any of a variety of user-

5   selectable units.

6

7   34. A data processing system incorporating a graphical
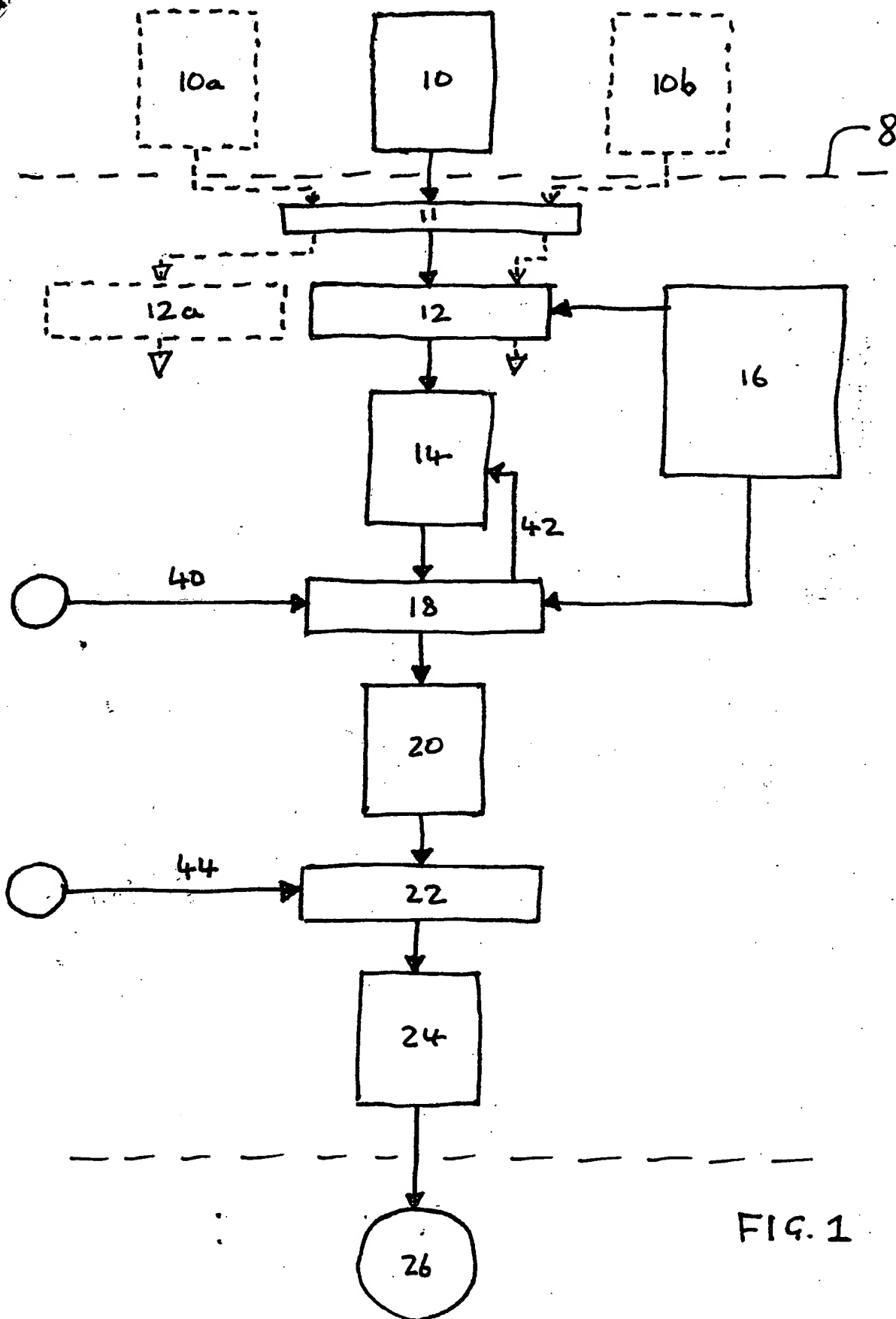
8   user interface as claimed in Claim 32 or Claim 33.

This Page Blank (uspto)

FIG. 1

This Page Blank (uspto)